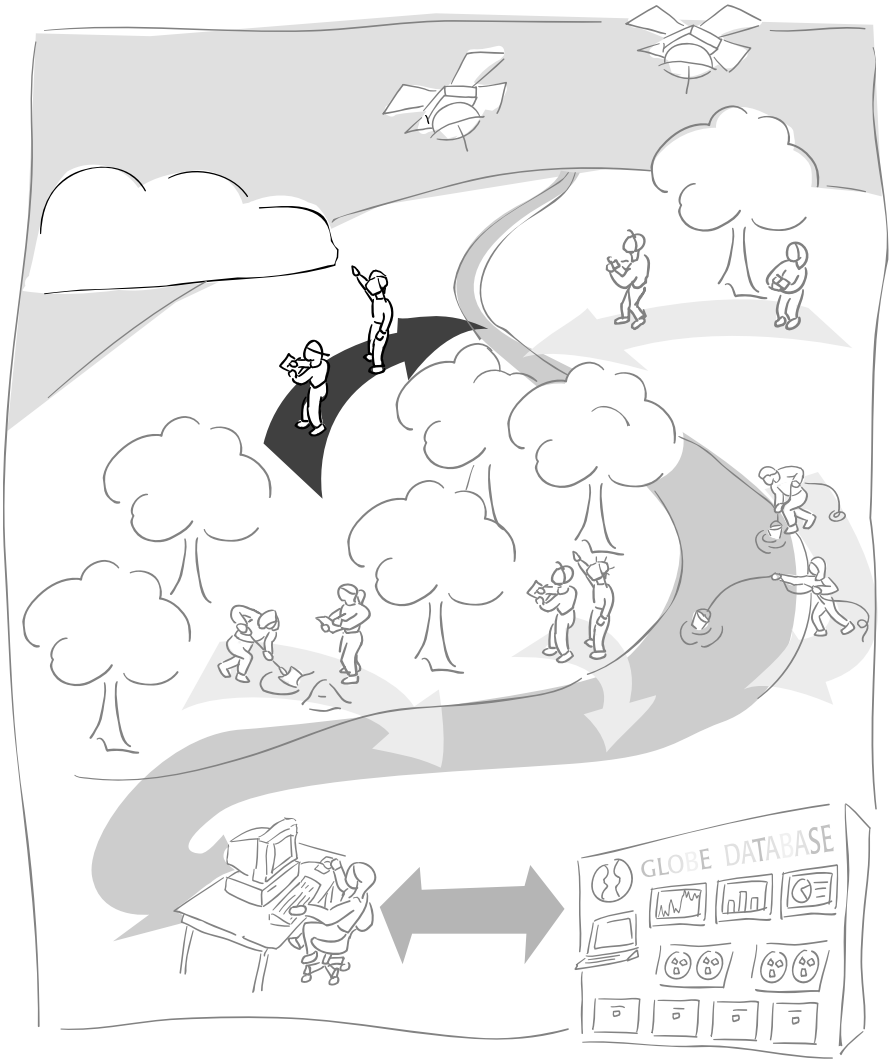
Earth System Science Investigation



A GLOBE® Learning Investigation

Earth System Science Investigation

Protocols

Daily, Seasonal Measurements

Basic
Budburst

Bi-weekly, Seasonal Measurements

Basic
Green-Up
Green-Down

Optional Measurements

Ruby-Throated Hummingbirds (daily or bi-weekly, seasonal)
Phenological Gardens (daily or bi-weekly, seasonal)

Suggested Sequence of Activities

- Read the Introduction to become familiar with seasons, phenology, and studying Earth system science at different space and time scales.
- If you want to do the *Phenological Gardens Protocol*, the best time to plant your garden is in the spring or autumn. You must wait a year to collect data.
- *What Can We Learn About Our Seasons*, *What Are Some Factors That Affect Seasonal Patterns*, *How Do Seasonal Temperature Patterns Vary Among Different Regions of the World* learning activities introduce students to characteristics and patterns of seasons.
- *Green-Up Cards, A Sneak Preview to Budburst,* and a *First Look at Phenology* learning activities set the stage for taking the phenology measurements.
- Choose one of the Phenology Protocols to start (*Green Down* or *Hummingbirds* in the fall; *Budburst*, *Green Up*, or *Hummingbirds* in the spring); Phenological Gardens throughout the year)
- *A Beginning Look at Photosynthesis* and *Investigating Leaf Pigments* learning activities help students better understand the process of photosynthesis.
- *Global Patterns in Green-Up and Green-Down* and *Limiting Factors in Ecosystems* allow students to explore global trends in green-up and green-down and to explore why these patterns occur in different ecosystems.
- *Modeling the Reasons for Seasonal Change* and *Seasonal Change on Land and Water* learning activities helps students understand factors that cause seasonal patterns.
- *Connecting the Parts of the Study Site, Representing the Study Site in a Diagram, Using Graphs to Show Connections, Diagramming the Study Site for Others*, and *Comparing the Study Site to One in Another Region* learning activities allow students to explore Earth system connections at the local scale.
- *Defining Regional Boundaries* and *Effects of Inputs and Outputs on a Region* learning activities allow students to explore Earth system connections at the regional scale.
- *Your Regional to Global Connections* and *Components of the Earth System Working Together* learning activities allow students to explore Earth system connections at the global scale.

Table of Contents

* See the full e-guide version of the *Teacher's Guide* available on the GLOBE Web site and CD-ROM.

** Separate print version available on request to schools in the areas where the protocol may be conducted. The protocol and related material are also available in the e-guide version of the *Teacher's Guide* available on the GLOBE Web site and CD-ROM.

*Learning Activities: Exploring the Connections**

Appendix

* See the full e-guide version of the *Teacher's Guide* available on the GLOBE Web site and CD-ROM.